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CANADA THISTLE and Methods of ERADICATION

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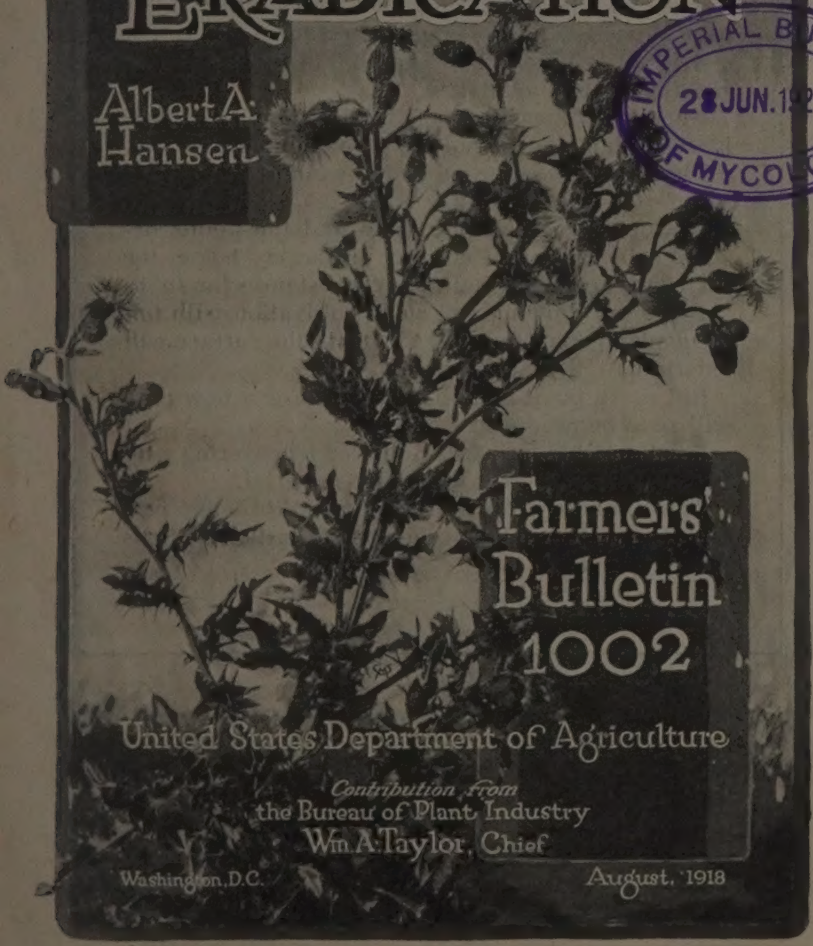

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THE CANADA THISTLE is not a native of Canada, but of Europe, whence it came both to Canada and the northern United States, where it has proved itself to be one of the worst farm weeds.

It is not common in the South, but is found occasionally in the mountains.

North of Pennsylvania it is disseminated widely by seeds, but also spreads by its creeping roots.

The seeds are scattered by the wind or distributed in infested hay or grain.

Its spread may be prevented and the plants destroyed by persistent cutting, preferably below the surface, before seed matures. This starves the roots.

Summer fallowing and clean cultivation with implements that cut the stalks beneath the surface will exterminate it.

But every plant must be destroyed or a new crop will soon be produced.

Small patches may be smothered by covering with boards, roofing paper, or similar material.

This bulletin illustrates and describes the pest and its manner of growth and gives tested methods of extermination.

CANADA THISTLE AND METHODS OF ERADICATION.

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DESCRIPTION OF THE CANADA THISTLE.

THE CANADA THISTLE[1] is an erect perennial, growing from 1 to 4 feet in height. The leaves are from 2 to 7 inches long, green on both sides, and are usually armed with numerous hard, slender, sharp-pointed spines. One variety of the Canada thistle, occurring in a few localities, has leaves practically free from spines. The leaves appear first as rosettes. If the rosette stage is formed early, the upright flowering stalk will appear during the same season, whereas if the rosette appears late the flowering stalk will not develop until the following season; the rosette meantime usually persists over winter. The imperfect-flowered and perfect-flowered plants are distinct, seed, of course, being formed on the perfect-flowered plants only.

The distinguishing features of the Canada thistle are (1) the deep-seated creeping roots, which grow in all directions, often to a length of a dozen feet or more, and send up new shoots at intervals (fig. 1), and (2) the small purplish flower heads, each about a half inch in diameter and smaller than the heads of most other thistles.

INTRODUCTION AND SPREAD OF THE PEST.

The Canada thistle is a native of Europe, where it has long been regarded as a vile weed, especially in the regions having climatic conditions similar to the northern half of the United States. It was regarded as a noxious plant even before the discovery of America.

It was probably first introduced into French America (now Canada) through the medium of impure farm seeds. Its very early introduction doubtless accounts for the statement of some of the earlier writers that the pest is native to Canada. It now occurs in Canada from British Columbia to Newfoundland.

[1] Aside from "Canada thistle," this weed has been termed "thistles," "cursed thistle," "green thistle," "corn thistle," "California thistle," "creeping thistle," "prickly thistle," "way thistle," "hard thistle," and "soft field thistle."

Technically, the following names of the Canada thistle are synonymous: *Serratula arvensis* L., *Cirsium arvense* Scop., *Carduus arvensis* Robs., and *Cnicus arvensis* Hoffm. All of these names except the first are still of frequent scientific usage; the name most generally accepted, however, is *Cirsium arvense*.

The plant was introduced early into the New England States in impure seed, probably not from Canada, as has so often been stated, but direct from Europe. The first official recognition of its presence in New England was in the Vermont law of 1795. The weed was apparently introduced into New York State almost simultaneously with its appearance in New England, but it was not until 1813 that the New York Legislature took action against it.

It was introduced into Fauquier County, Va., during the Civil War, probably by means of baled hay sent to feed the horses of the

FIG. 1.—Several plants of the Canada thistle originating from a single creeping root and representing the growth of one season, starting with a seed planted in the spring. A portion only of the actual growth is here shown. Note the lack of surface roots exhibited by the individual plants.

Union Army. This vicinity still marks practically the southern limit of the Canada thistle range, and there is little danger of a further spread southward, since the climatic conditions in the South are not favorable for the growth of the plant. This belief is upheld by the fact that the plant failed to maintain itself after being introduced into Florida, Alabama, and Louisiana. However, it has found its way southward into the cooler sections of the Appalachian Mountain regions, where the conditions are favorable for its development. The weed has not as yet become troublesome in the southern Appalachian Mountain regions.

The Canada thistle was not reported west of the Allegheny Mountains until later than 1835. At the present time it may be found in practically all the northern half of the United States, from the Atlantic to the Pacific (fig. 2). During recent years it has become increasingly troublesome in the grain-producing areas of the Northwest.

CONFUSION WITH OTHER PLANTS.

There are many plants with which the Canada thistle is likely to be confounded, the principal one being the bull thistle.[1] Both plants are noxious weeds and should be exterminated, but it is important to

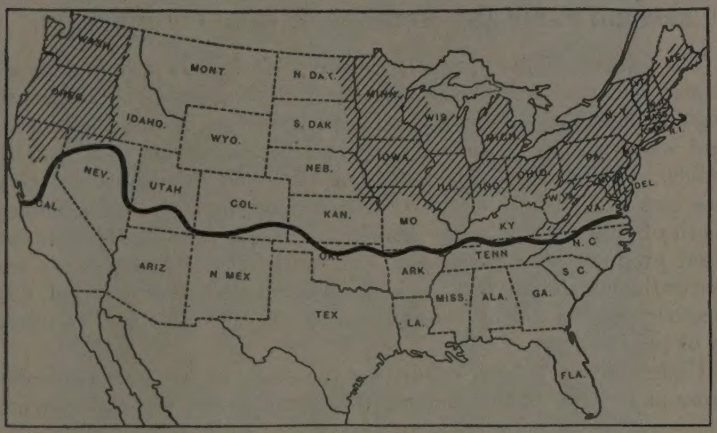

FIG. 2.—Map of the United States, showing the present distribution of the Canada thistle. The heavy line indicates the approximate southern boundary of the weed; the shaded area shows where the plant is most injurious.

know which is being dealt with, since different control treatments are necessary. The following points of difference should be noted:

(1) The head of the bull thistle is larger and of a different shape from that of the Canada thistle.

(2) The bull thistle is a biennial plant and does not possess the creeping roots so characteristic of the Canada thistle; hence the bull-thistle plants usually occur isolated in the field, whereas the Canada thistles grow typically in patches.

(3) The leaves of the bull thistle are larger and thicker than those of the Canada thistle.

(4) The main stem of the bull thistle possesses a tuft of roots close to the surface of the ground, which is not true of the Canada thistle.

(5) The mature plant of the bull thistle is larger and darker green in color than the mature plant of the Canada thistle.

(6) The main stem of the bull thistle is heavier than that of the Canada thistle.

[1] *Cirsium lanceolatum*.

Various other thistles are often mistaken for the Canada thistle; each of them, however, possesses a taproot and lacks the creeping roots that distinguish the Canada thistle. Other plants locally known as the Canada thistle but bearing little or no resemblance to it are the horse nettle,[1] Russian thistle,[2] and spiny cocklebur,[3] all prickly plants. In California the milk thistle[4] was long mistaken for the Canada thistle, and legislation worded against the latter plant was enforced against the milk thistle until a lawsuit rectified the mistake.

Whenever there is doubt about the identity of the plant, specimens should be sent to the State agricultural experiment station or to the United States Department of Agriculture.

SEEDING HABIT AND METHODS OF SEED DISTRIBUTION.

The Canada thistle produces seed irregularly. It may seed abundantly one year and not at all the following season. There are regions, however, in which good seed is seldom, if ever, produced, and when seed is found only a small percentage of it is usually viable. If the southern boundary of Michigan were continued as a line east and west, it would constitute approximately the boundary south of which viable seed is rarely found. In New York State the weed produces seed frequently, whereas in Pennsylvania seeds are not ordinarily found. It has been observed that wherever cool, dry weather persists during the pollination period viable seed is likely to be produced.

Under ordinary farm conditions the seeds in the soil, especially those at or close to the surface, may germinate at any time during the growing season. The conditions at a depth greater than 3 to 4 inches are usually unfavorable to germination, but seeds buried at such depths may remain viable for some time, ready to germinate when brought nearer to the surface by cultivation.

In combating a weed such as the Canada thistle it is necessary to know the various methods by which the plant is disseminated, in order to guard against its further distribution on the farm. One of its principal methods of dissemination is by means of seeds, which are distributed in a variety of ways.

Distribution by the wind.—Each individual seed is equipped with a fringe of hairs known as a pappus, which, acting much like a tiny parachute, permits the seed to be carried by the wind.

As a single colony of plants may serve as a source of infestation for a considerable area of the surrounding territory, the eradication of the Canada thistle is as much a problem for the community as for the individual farmer and should be handled accordingly.

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[1] *Solanum carolinense.*
[2] *Salsola kali tenuifolius.*
[3] *Xanthium spinosum.*
[4] *Silybum marianum.*

Distribution in impure seed.—The commonest method by which the Canada thistle is introduced into new localities is by means of impure seed, principally that of grass and clover (fig. 3). This accounts in large part for the fact that 26 States have enacted laws directed against the pest. To permit the plant to mature seed is specifically

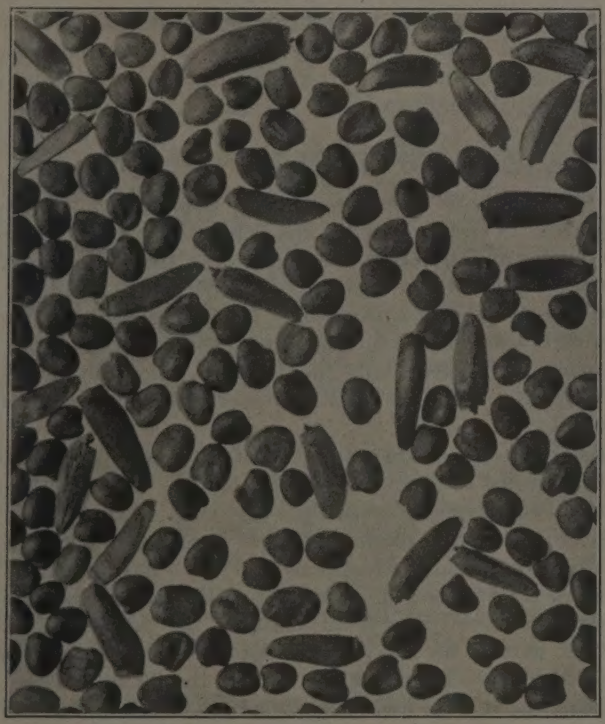

FIG. 3.—Impure clover seed containing a large percentage of the seed of the Canada thistle. The commonest method by which this weed is introduced is by means of impure seed.

forbidden by practically all of these laws. If the presence of Canada thistle seed is suspected in other seed, a sample should be sent either to the State agricultural experiment station or to the Seed Laboratory of the United States Department of Agriculture,[1] in order that the purity of the seed may be determined. This service is rendered

[1] In addition, seed samples may be submitted for analysis or identification to any of the following laboratories, maintained through the cooperation of the United States Department of Agriculture: Branch Seed-Testing Laboratory, Agricultural Experiment Station, Columbia, Mo.; Branch Seed-Testing Laboratory, Agricultural Experiment Station, Baton Rouge, La.; Branch Seed-Testing Laboratory, Oregon Agricultural College, Corvallis, Oreg.; Branch Seed-Testing Laboratory, Purdue University, La Fayette, Ind.; Branch Seed-Testing Laboratory, California Agricultural Experiment Station, Berkeley, Cal.

without cost. The seeds most commonly containing Canada thistle seed are the clovers, timothy, the small grains, and Canada bluegrass.

Miscellaneous methods of distribution.—Seeds may be disseminated by means of farm machinery, such as thrashing machines. These machines should always be cleaned before being moved from one farm to another.

The weed is sometimes transported long distances in hay or in packing around crockery, nursery stock, etc. Railroads and other transportation lines as well as the coats of animals are more or less important distributing agencies.

CHARACTER OF UNDERGROUND PARTS.

The Canada thistle possesses running roots which penetrate the ground often 15 inches or more, the depth being largely dependent on the amount of cultivation, the character of the soil, and the depth of the water table. Cultivation serves to increase the depth to which these roots extend. On land untilled for a long period of years the roots usually are close to the surface. The character of the soil is also important in determining the depth to which the underground parts penetrate, since the roots will normally grow deepest in a mellow soil.

A single root may produce many shoots, which appear at different times throughout the growing season (fig. 1). The growth of the roots serves effectively to spread the pest over considerable areas of ground. Furthermore, plows and other implements may break the roots into pieces, each of which may produce a new plant and by so doing start a new area of infestation. The roots also divide by natural means, usually due to the decay of the older parts. During the autumn most of the nutriment contained in the stem and leaves is transferred to the underground parts, and the plants die back when frost comes, the vertical root being killed to a depth of 5 to 10 inches. This suggests that cutting the plants in the fall is of little practical value, since extra nutrition is then stored in the deep-seated roots.

ERADICATION OF THE WEED.

In the eradication of the Canada thistle there are many factors to consider, one of the most important of which is the weather. The weed is much easier to eradicate during droughts than during wet weather. The operations of plowing, harrowing, and cultivating directed against the thistle should never be undertaken when the land is wet.

Control methods for the Canada thistle should aim at complete eradication; if only a few plants survive, they are usually sufficient to cause serious reinfestation in a comparatively short time. To

secure complete eradication the underground parts must be completely killed, since it is principally by these that the pest lives over from year to year. The most practical method of exterminating these underground parts is to starve them out by frequently destroying all the top growth of the plants. Since plants can assimilate food only by the aid of green leaves, the frequent cutting of the tops uses up food stored in the fleshy roots.

ERADICATION ON SMALL AREAS.

The importance of eradicating the Canada thistle on small areas can hardly be overestimated, since the pest spreads readily, and a small patch may be the direct cause of infesting an entire farm almost before the farmer is aware of the presence of the weed.

There are several methods by which small-area infestations may be eradicated, the commonest and most practical of which is the frequent cutting of the green growth by means of a hoe, spud, or some other cutting instrument. It is desirable to sever the stems a few inches below the surface of the ground. This will cause the eventual starvation of the weed, but perseverance is needed to insure success. If the patch is very small, it is sometimes practicable to dig out the plants, roots and all.

Smothering is practicable on limited areas. Cover the infested spots with tar, building, or some other kind of heavy paper, which should be laid with overlapping edges well weighted down with earth or stones so that no light can penetrate. At least one entire season will be necessary for success.

Covering with coatings of straw, hay, sawdust, and various other things has not proved uniformly successful, because the thistle plants will grow through the covering. Small patches may be eradicated by covering them with at least 18 inches of manure for a minimum period of a year. A helpful practice is to locate the thrashing machine so that the straw pile will cover a patch of Canada thistle, but this method is successful only when the straw pile is large enough to extend some distance beyond the edge of the thistle patch.

The use of chemical plant poisons is practicable on small areas. The application of crude carbolic acid, hot brine, sulphuric acid, kerosene, or of strong solutions of caustic soda or arsenite of soda to the newly cut surfaces has been successful, but the expense is heavy. Arsenite of soda is a deadly poison and must not be used in places to which live stock have access. Crude carbolic acid and kerosene are best applied by means of an ordinary machinist's oil can. Salt persistently applied to the newly cut surfaces will eradicate thistles.

Canada thistles growing in waste places and along fence rows, railways, and roadways should never be allowed to mature seed and thus act as a constant menace to surrounding lands. Such infestations

should be eradicated. If the eradication is not complete, the thistles should be mowed at least twice a year, to prevent seeding.

ERADICATION ON LARGE AREAS.

Two principal plans of eradication are applicable on large areas. It is always well to keep in mind that eradication is secured only through the starvation of the roots by the removal of top growth. Too often the work is neglected when extermination has been almost attained. Given the least opportunity, the Canada thistle will reestablish itself very rapidly.

The thistle grows best on rich, loamy, moist soils; hence thistle-infested land is usually well worth reclaiming.

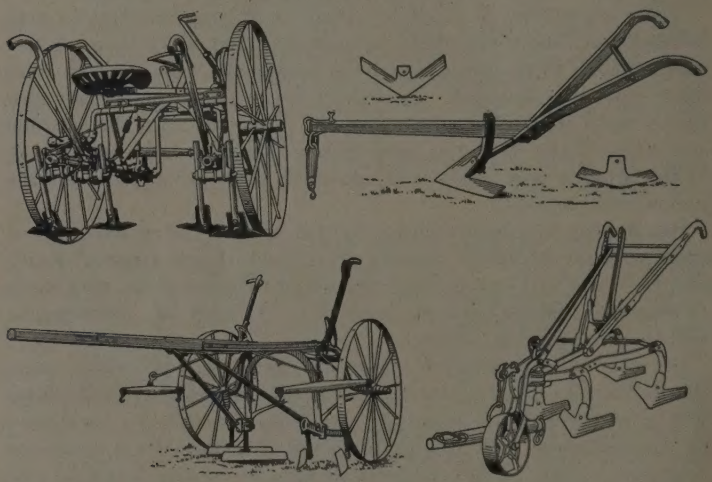

FIG. 4.—Various types of cultivators equipped with knives or sweeps that are effective in cutting off the stems of perennial weeds below the soil surface.

Clean cultivation with a crop.—This method has the advantage of killing the weeds without losing the use of the land while so doing.

In a well-prepared seed bed, plant a cultivated crop, such as corn, using the checkrow system, if practicable. Cultivate thoroughly, in order to prevent the development of thistle leaves. The shoots must be cut off no less than six or eight times during the season if complete success is to be attained. It will be necessary to go through the crop occasionally with a hand hoe in order to clean out the plants growing so close to the corn that they escaped the cultivator.

The best implement for cultivation is the sweep or knife type of cultivator (fig. 4). The shovel and tooth types of harrows and cul-

tivators, so commonly used in the East, are not so efficient, since they allow much of the top growth of the thistles to slip through. Special sweep or knife cutting implements may be used, or separate sweeps may be purchased and attached to the cultivator in place of the shovels. Sweeps are adapted to loose, friable soils only; their use should not be attempted in cloddy or stony soils. After it becomes impracticable to cultivate longer, any thistle tops which appear should be cut back with a hoe until frost.

A single season of careful, painstaking work will frequently serve to exterminate the thistle; less time is really required than is generally believed, provided the work is thoroughly done.

The following season another cultivated crop should insure the success of the plan.

Summer fallowing followed by a cultivated crop.—Like the plan of eradication described on page 10, summer fallowing followed by a cultivated crop keeps in check the top growth and starves the root system, thereby eradicating the pest. The plan is well suited for large areas.

Just previous to the blossoming of the thistle, which is the stage at which the plant is most easily destroyed, plow shallow. During the remainder of the growing season cultivate with a disk harrow or with sweeps at intervals often enough to prevent a maximum of 3 inches of thistle growth at any time. Continue this practice until fall. If the thistle roots are sufficiently near the surface, plow deep enough to expose them to the effects of winter frosts.

The following spring plant the land to a cultivated crop, such as corn, and give careful cultivation to see that no thistle tops survive. The cultivated crop will enable one to destroy any thistles that may appear. The thistles should be entirely eradicated when the crop is matured.

ERADICATION METHODS IN PRACTICE.

The methods of eradication previously outlined may be illustrated by the experience of a farmer who purchased a farm in the corn belt. The land was so badly infested with Canada thistles that it was obtained at a very low price. In cooperation with the Department of Agriculture he outlined a campaign against the thistles, having in mind the single object of keeping down the top growth of the weeds. He divided his farm into three fields of approximately 25 acres each.

Field 1.—In field 1, containing about 3 acres of thistles, he planted corn in checkrows, cultivating with an implement on which the ordinary shovels had been replaced with 9-inch sweeps, the edges of which were kept well sharpened.

When the corn was laid by, the use of the sweeps ceased, and handwork with a hoe was substituted. At first, weekly cuttings were

necessary, chopping the thistles off well below the surface, but the intervals between which chopping was necessary became longer and longer as the season advanced. This handwork was done at odd times, though systematically carried out. After the removal of the corn crop the entire field was plowed. The following spring another crop of corn was planted, but no thistles appeared. The pest was thus eradicated in a single season because a systematic plan was strictly followed. The extra labor involved was small compared with the results obtained.

Success should not always be looked for in a single season, since unfavorable weather conditions may delay eradication, but extermination of the Canada thistle is possible by the effort of one season only.

Field 2.—Field 2 was pastured throughout the first season. An area of about 2 acres was thickly set with the thistles and numerous small isolated patches were scattered over the remainder of the field. In June, just previous to flowering, the thistles in the small isolated patches were cut below the surface of the ground with a hoe. This practice was continued until fall at intervals frequent enough to prevent more than 3 inches of thistle growth from appearing. The handwork was heaviest at first, diminishing considerably as the season advanced. The following year the land was plowed, planted to corn, and given careful cultivation. At the end of this second season the Canada thistles had been completely exterminated.

The heavily infested area was so thickly covered with thistle growth that the plan practiced on the remainder of the field was hardly practicable; hence a different treatment was given. These 2 acres were plowed in June, just previous to the blossoming period of the thistle. After plowing, the land was disked. The disking was continued at intervals frequent enough to keep down the top growth of the thistles throughout the remainder of the growing season. Two diskings a week were necessary at first, but as the season advanced, this number was gradually reduced in proportion to the loss of vigor of the thistles, until toward the end of the summer one disking every other week served the purpose. The following year no crop was planted, but the natural growth contained no evidence of the thistle. The work had been so thoroughly done that the weed was completely eradicated in a single season of effort. It is the best practice, however, to follow a season of fallowing with a cultivated crop, in order to catch any stray thistle plants which may survive the fallow.

Field 3.—When the experiment started, field 3 was sown to oats. In the most heavily infested patches the thistles were cut, along with the oats, just previous to the blossoming of the weed. Throughout the remainder of the field all the thistle plants were cut below the crown in June, so none was allowed to mature seed. The oat crop

was followed by winter wheat, but in this instance the wheat failed because of weather conditions; hence the field was put into grass and clover the following season. In this grass crop the most heavily infested spots were cut frequently, grass and all, while in the remainder of the field handwork was necessary to keep back the thistle growth. A clean hay crop was the result. All the work up to this stage was performed with the object of weakening the vitality of the thistle and to prevent it from seeding, while in so doing clean crops were produced. This treatment kept the weed in check until the field was ready for a cultivated crop to eradicate the thistles.

Why success was attained.—Success in the case of the three fields just cited was due to (1) the outlining of a careful plan of attack, (2) faithful adherence to the plan, and (3) the use of proper implements.

It should be noted that the initial work was the heaviest; as the season advanced the labor became proportionately lighter. Perhaps the principal reason for success was the perseverance with which the work was done. When the corn crop was laid by, for instance, the work with the weed was continued, giving it no chance to grow and replenish the depleted stock of food stored in the roots. The handwork with the hoe was regarded as just as necessary as any other farm work.

MINOR METHODS OF ERADICATION.

Many minor methods of eradication have proved successful, and some suggestions that should be helpful follow.

Smothering.—The Canada thistle does not withstand shade well; hence smothering crops are sometimes successful. The best of these crops appears to be hemp, while millet, buckwheat, alfalfa, sorghum, the grasses, the small grains, and field peas are all helpful. Hemp is especially to be recommended in sections where it can be grown successfully. Alfalfa has been found to be very useful, because of the frequent mowing which this crop receives. During years of prolific thistle-seed production winter grains usually kill a large number of the thistle seedlings. A rotation consisting of a cultivated crop followed by a winter cover crop, which in turn is followed by a smother crop, is perhaps the best method of utilizing smother crops in combating the thistle. Thus in several parts of the country corn planted in checkrows is followed by rye as a winter crop. The rye is cut for hay, after which the land is planted to alfalfa. Very few Canada thistles are able to survive this rotation.

Years of effort are usually necessary to clear the land of the thistle by the smothering plan, and sometimes only partial success is attained. Smother crops are generally successful only upon relatively rich soils. Smothering will be found most useful when following a cultivated crop, thus killing the thistles which survived cultivation.

Grazing.—Normally few, if any, animals will feed upon the Canada thistle, although if no other forage is available sheep and goats may be forced to graze the weed. It is significant that thistles are rarely found upon land grazed by either sheep or goats. The salting of numerous small thistle plants will greatly facilitate eradication, since it will aid in inducing the animals to overcome their dislike for the prickly pest. Close grazing will have the effect of starving out the underground parts.

Spraying with chemical plant poisons.—As a practical method of eradication under ordinary farm conditions the much-advertised plan of spraying with chemicals is not to be advocated. It may prove useful, however, where the thistle grows in rocky situations, where the weed often infests stone fences in such a manner as to render eradication by any means other than spraying a very difficult matter. Under these conditions it may prove profitable to spray the plants with a solution of 1 pound of arsenite of soda dissolved in 6 gallons of water, using a hand sprayer for the purpose. The plants should be sprayed first when about half grown and again when the new growth has attained a height of about 6 inches. A third spraying will usually be necessary when the young thistles are about 6 inches high.

HELPFUL SUGGESTIONS.

Several suggestions regarding the handling of the Canada thistle may prove helpful.

The thistle typically occurs in isolated patches. It is advisable not to plow through such patches, since by so doing pieces of the roots will undoubtedly be scattered to many parts of the field, thus increasing the area of infestation. A small piece of root, not more than a quarter of an inch in length, is sufficient to start a new plant. Small patches should be treated by the methods previously explained. If, however, it is necessary to plow through a thistle patch, care should be taken to clean the plow thoroughly afterwards, in order to avoid the danger of scattering the root pieces.

Grain fields heavily infested with Canada thistles may be cut for hay profitably while green rather than allow the thistle seeds to mature. Hay fields containing a large quantity of thistles should be cut early, as this will prevent the thistles from going to seed. This is especially important in the northern range of the thistle, where it is known that it frequently produces seeds.

Topping thistles in grain fields is often advisable just before the thistles commence to head; the blossom heads at that stage stand above the surrounding grain. Removing these heads will retard the growth of the thistles so that few, if any, will mature seed before the removal of the grain. The work can be done rather rapidly

with knives or sickles. This method is especially applicable where only a few patches of thistles are present.

Manure may become infested with the seeds of the Canada thistle by means of infested hay or stock feed. It is possible for thistle seeds to pass through the digestive tracts of animals and retain their vitality. In the case of hay, the seeds may get into the manure either by passing through the digestive tract or by dropping from infested hay directly into the manure.

Screenings from grain grown in infested areas should be ground fine before being fed to stock. This practice not only kills the Canada thistle seed, but in addition kills many other noxious weed seeds.

If infested hay or stock feed has been used, composting for a period of not less than three months will destroy the thistle seed together with many other weed seeds that are in the manure. In case the farm is thistle free, this plan will insure safety. Whether the manure should be composted or not is a problem to be solved by the individual.

In some sections of the country the Canada thistle is infested with a rust[1] which prevents many seeds from maturing. It has been suggested that the weed can be controlled by introducing and encouraging the spread of this disease, but all experiments to test this plan so far have failed.

[1] *Puccinia suaveolens.*